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CLAIMS

1. A method of producing a bonded assembly comprising a diamond element, the method including the steps of providing a diamond element selected from polycrystalline CVD diamond, single crystal CVD diamond, natural single crystal diamond, and single crystal diamond2 synthesised by high temperature/high pressure techniques, and at least one other structural element for the assembly, contacting at least one surface on the diamond element with at least one surface on the structural element, and applying electron beam heating to a localised region of the contacting surfaces to cause bonding of at least a portion of the contacting surfaces in that region.
2. A method according to claim 1, wherein the structural element is formed of a material that is capable of forming a diffusion or diffusion-type bond with the diamond element.
3. A method according to claim 2, wherein the structural element is formed of a carbide forming material.
4. A method according to claim 3, wherein the structural element is formed of titanium or molybdenum.
5. A method according to claim 1, wherein a surface of the diamond element is coated or otherwise provided with a layer of a material that is capable of forming a diffusion or diffusion-type bond with the diamond element, the coated surface of the diamond element being brought into contact with the structural element prior to the localised application of electron beam heating to cause bonding of at least a portion of the contacting surfaces.

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6. A method according to claim 5, wherein the structural element is formed of a ferrous metal, a non-ferrous metal, or an alloy of either such metal.
7. A method according to claim 6, wherein the structural element is formed of copper, aluminium or steel.
8. A method according to any one of claims 5 to 7, wherein the coating layer is formed of a carbide forming material.
9. A method according to claim 8, wherein the coating layer is formed of titanium or molybdenum.
10. A method according to any one of the preceding claims, wherein the electron beam heating is carried out under conditions in which the temperature of the surface of the structural element bonding to the diamond does not exceed its melting point.
11. A method according to claim 10, wherein the temperature of the surface of the structural element bonding to the diamond does not exceed 80% of its melting point.
12. A method of producing a bonded assembly comprising a diamond element, the method including the steps of providing a diamond element selected from polycrystalline CVD diamond, single crystal CVD diamond, natural single crystal diamond, and single crystal diamond synthesised by high temperature/high pressure techniques, and at least one other structural element for the assembly, which structural element is formed of material that is capable of forming a diffusion or diffusion-type bond with diamond, contacting at least one surface on the diamond element with at least one surface on the structural element and applying electron beam heating to a localised region of the contacting surfaces to cause

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bonding of at least a portion of the contacting surfaces in that region.

13. A method of producing a bonded assembly comprising a diamond element, the method including the steps of providing a diamond element selected from polycrystalline CVD diamond, single crystal CVD diamond, natural single crystal diamond, and single crystal diamond synthesised by high temperature/high pressure techniques, and at least one other structural element for the assembly, coating at least one surface of the diamond element with a material that is capable of forming a diffusion or diffusion-type bond with diamond, contacting the at least one coated surface of the diamond element with at least one surface of the structural element, and applying electron beam heating to a localised region of the contacting surfaces to cause bonding of at least a portion of the contacting surfaces in that region.
14. A method according to claim 12 or claim 13, wherein the electron beam heating is carried out under conditions in which the temperature of the surface of the structural element bonding to the diamond does not exceed its melting point.
15. A method according to claim 14, wherein the temperature of the surface of the structural element bonding to the diamond does not exceed 80% of its melting point.
16. A method according to any one of the preceding claims, wherein the diamond element is a layer of diamond.
17. A method according to any one of the preceding claims, wherein the structural element is a frame or mount.
18. A method according to any one of the preceding claims, wherein the electron beam heating takes place in a vacuum.

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19. A method according to any one of the preceding claims, wherein the electron beam heating takes place at currents in the range of 0.01A – 10A and voltages in the range of 1 kV – 100 kV.
20. A method according to any one of the preceding claims, wherein the diamond element is polycrystalline or single crystal CVD diamond.